Section 1.4 Part I: The Matrix Equation

MATH 204: Linear Algebra
Prepare for class September 7, 2018 Name (Print): _____

After reading Section 1.4 (pages 35-40), answer the following questions.

1. The matrix-vector product is defined on page 35. If A is an $m \times n$ matrix with columns $\mathbf{a_1}, \mathbf{a_2}, \ldots, \mathbf{a_n}$ and if $\mathbf{x}$ is in $\mathbb{R}^n$ then the product of A and $\mathbf{x}$, denoted by $A\mathbf{x}$, is

$A\mathbf{x} =$

2. Using the definition in (1), if $A = \begin{bmatrix} 2 & -1 & 4 \\ 0 & 3 & 1 \end{bmatrix}$ and $\mathbf{x} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, compute $A\mathbf{x}$. Be sure to use the definition in (1) and show each step.

3. Suppose A is an $m \times n$ matrix. Can we always compute $A\mathbf{x}$ for any vector $\mathbf{x}$? Why or why not?

4. Suppose $\mathbf{v_1}$, $\mathbf{v_2}$ and $\mathbf{v_3}$ are vectors in $\mathbb{R}^m$. Write $7\mathbf{v_1} - 5\mathbf{v_2} + 8\mathbf{v_3}$ as a matrix times a vector.

5. Write the following system of equations as a vector equation and then as a matrix equation.

$$\begin{aligned} x_1 - 3x_2 + 2x_3 &= 7 \\ 4x_1 + x_2 - 6x_3 &= 2 \\ 5x_1 + 6x_2 - 8x_3 &= 0 \end{aligned}$$

6. Fill in the blank two ways (that is, find two different ways of expressing the same idea): The equation $A\mathbf{x} = \mathbf{b}$ has a solution if and only if $\mathbf{b}$ is

_____.

or _____.

7. Write down the statement of Theorem 3 on page 36. What does the text say is powerful about this theorem?